Earth's Atmosphere
ES-4 The student will demonstrate an understanding of the dynamics of Earth's atmosphere.

ES-4.5 Explain the relationship between the rotation of Earth and the pattern of wind belts.
Taxonomy level: 2.7-B Understand Conceptual Knowledge

Previous/future knowledge: Students were introduced to global wind belts in 6th grade (6-4.9) as they studied the effects that global winds had on weather and climate conditions. The Coriolis effect has not been introduced in any prior grades.

It is essential for students to know that the circulation of the atmosphere is affected by the rotation of Earth on its axis. The rotation causes the surface winds in the Northern Hemisphere to be deflected to the right and those in the Southern Hemisphere to be deflected to the left. This motion is called the *Coriolis effect*. The Coriolis effect deflects winds that would otherwise blow directly from a high-pressure area toward a lower-pressure area from that path.

Because convection cells are in place in the atmosphere and Earth is spinning on its axis, *global winds* are found in each convection region. Students need to understand the *global wind belt* regions, the prevailing direction of the wind, and how air movement in these large regions affects weather patterns.

Trade winds:	• The *trade winds* blow from east to west in the tropical region moving warm tropical air in that climate zone. Like all winds they are names according to the direction from which they flow, the northeast trade winds or the southeast trade winds.
Westerly winds:	• The prevailing *westerly winds* blow from west to east in the temperate region. The temperate zone temperatures are affected most by the changing seasons, but since the westerly wind belt is in that region, the weather systems during any season move generally from west to east. Since the United States is in the westerly wind belt, the weather systems move across this country from west to east. (Tropical weather systems, for example, hurricanes, are moved in the prevailing easterly direction of the trade winds. If they enter the westerly wind belt, they are often turned, and move in the direction of that prevailing system.)
Polar winds:	• The *polar winds* blow northeast to west in the polar region, often called the polar easterlies, moving cold polar air in that climate zone from the poles toward the west. Where the polar easterlies meet warm air from the westerlies, a stormy region known as a *polar front* forms.

It is not essential for students to know the details of shifts in wind belts due to changes in seasons or the cause and effects of the jet streams.

Assessment Guidelines:
The objective of this indicator is to *explain* how the rotation of Earth is related to global wind belt patterns; therefore, the primary focus of assessment should be to construct cause and effect models of global winds responding to the Coriolis effect due to the rotation of Earth.
In addition to *explain* appropriate assessments may require students to:
- *compare* the wind belt regions as to wind direction and influence on weather patterns;
- *recall* the effect on surface winds of the Coriolis effect; or
- *identify* global wind belts based on descriptions.